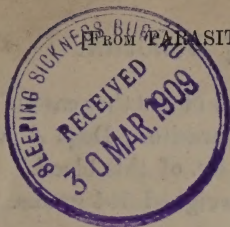


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INOCULATION OF DOGS WITH THE PARASITE OF KALA
AZAR (*HERPETOMONAS* [LEISHMANIA] *DONOVANI*)
WITH SOME REMARKS ON THE GENUS *HERPETO-*
MONAS.

BY CAPTAIN W. S. PATTON, I.M.S.

SINCE the discovery of the parasite of Kala Azar by Lt.-Col. Leishman, R.A.M.C., a number of investigators have endeavoured to reproduce the disease in the lower animals but without success. The recent discovery of Nicolle that dogs are susceptible to an allied human parasite (*Herpetomonas infantum*) has added a fresh stimulus to work along these lines, and in order to see whether the dog can be infected with *H. donovani* I carried out some inoculation experiments, which I propose recording in this paper.

Three young dogs were selected from a number of specimens brought to the King Institute; they had no ticks on them nor were they infected with *Piroplasma canis* and beyond being somewhat emaciated they were good specimens of bazaar dogs. Through the kindness of Lt.-Col. Robertson, I.M.S., I was able to obtain 10 c.c. of splenic blood from two typical cases of Kala Azar, and on examining some films it was found to be rich in parasites.

The dogs were inoculated as follows:

	Date	Weight	
Dog A.	9 June, 1908.	550 grms.	Inoculated with 2 c.c. intra-hepatic and 2 c.c. intra-peritoneal.
Dog B.	9 June, 1908.	306 grms.	Inoculated with 2 c.c. intra-hepatic and 2 c.c. intra-peritoneal.
Dog C.	9 June, 1908.	1124 grms.	Inoculated with 2 c.c. intra-peritoneal.

The inoculations were carried out with the greatest care, so that there could be no doubt that all the dogs received large numbers of the living parasites. The dogs were kept in clean iron cages free from ticks, their blood being examined at intervals with negative results. On June 19th the dogs were weighed and found to be as follows: Dog A, 820 grams, Dog B, 392 grams and Dog C, 1246 grams. On

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20

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June 30th Col. Robertson punctured the spleen of another case of Kala Azar and I obtained 6 c.c. of blood rich in parasites; Dogs A and B were each inoculated intra-peritoneally with 3 c.c. of this blood.

Dog B was killed on August 4th, when it weighed 514 grams. The following are the post mortem findings:

Spleen. Weight $12\frac{1}{2}$ grams, it appeared quite healthy; eight smears were made from different parts of the pulp and stained with Giemsa's stain. I was unable to find any parasites in them.

Liver. Weight 118 grams, there were no macroscopic appearances to be noted; eight smears were made from different situations, and were stained with Giemsa's stain. No parasites could be found.

The kidneys, lungs, intestines and peritoneum were quite healthy, and no parasites could be found in the bone marrow.

Dog A was killed on August 11th, when it weighed 1272 grams.

Spleen. Weight 26 grams, no macroscopic changes; 12 smears were made as above, but no parasites were found.

Liver. Weight 255 grams, healthy; eight smears were made, but they contained no parasites.

All the other organs were healthy.

Dog C is at present in the Institute at Madras.

From these experiments it would therefore appear that the dog is not susceptible to *Herpetomonas donovani*. The few dogs I have had the opportunity of examining in Madras have never harboured this parasite, and Christophers, who has had a much larger experience with these animals, does not record its occurrence.

Should it eventually prove to be the case that no animals are susceptible to the parasite of Kala Azar, it would further support the view that the Indian and Assam species is distinct from the Tunisian organism. I have been unable to collect any evidence in Madras that would support the view that dogs play any part in the transmission of Kala Azar. In Madras it is essentially a house disease and few of the people in Georgetown, where it is very prevalent, keep dogs.

*The Genus Herpetomonas*¹.

Believing as I do that the parasite of Kala Azar and its two allies belong to the genus *Herpetomonas*, I have for the last two years made a special study of this genus. These flagellates are parasitic in the

¹ This portion of the paper should be read in conjunction with my description of *Herpetomonas lygaei* in the *Archiv für Protistenkunde*, Vol. xiii. p. 1, 1908.

intestinal tracts of insects, non-blood-sucking and blood-sucking, and it should be clearly understood that those species occurring in the latter have no connection with any blood parasite, nor are they cultural trypanosomes; they have a characteristic developmental cycle which may be conveniently divided into three stages, *pre-flagellate*, *flagellate* and *post-flagellate*.

In their pre-flagellate stages they are round or oval bodies of varying size, and contain two characteristic chromatic bodies, the nucleus and blepharoplast. In this stage they multiply by simple longitudinal fission or by multiple segmentation, and are found in the midguts of their insect hosts, except in the case of the three human parasites. I have been able to show that this stage in a known species occurring in *Culex* mosquitoes is exactly similar to that of the human parasites. The flagellate stage is characterised by the formation of a single flagellum and the multiplication of the resulting flagellates by equal or unequal longitudinal division. The adult forms are long, spindle-shaped organisms, with a single flagellum, but no undulating membrane. This stage occurs in the mid- and hindgut of their hosts, but in the case of *Herpetomonas donovani* it takes place naturally in *Cimex rotundatus*. The post-flagellate stage is characterised by the massing together of the flagellates in the midgut, their shortening and rounding up, the resulting cysts are passed out in the faeces and are accidentally sucked up by fresh hosts. It is not known yet whether *H. donovani* undergoes this stage in the bed-bug.

It is important to remember that many of these *Herpetomonads* are indistinguishable in their *pre-flagellate stages*, and therefore if this stage alone is studied two distinct species may be classed as one. Further, I wish to point out here that a partial study of the stages of these flagellates is very apt to lead to confusion, so that what are true *Herpetomonads* may quite easily be mistaken for *Crithidia* or young *Trypanosomes*; a reference to recent literature will show that this has actually occurred in more than one instance.

As the life-cycles and general structure of the three human parasites are similar to those of well-known *Herpetomonads*, I see no reason for placing them in a distinct genus. The differences in their development, such as the formation of the flagellum, methods of division and the fact that their *pre-flagellate* stages are passed in man only justify their being regarded as specifically distinct from such species as *H. muscae domesticae*, *H. sarcophagae*, *H. culicis*, *H. lygaei*, and many others.



The first point to be considered is the question of the origin of the human race. It is a question which has been discussed for many years, and it is one which has not yet been settled. There are two main theories, the one of which is that the human race originated in Africa, and the other is that it originated in Asia. The first theory is based on the fact that the earliest fossils of man have been found in Africa, and the second theory is based on the fact that the earliest fossils of man have been found in Asia.

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